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(54) **Gripping mechanism for printing machine**

(57) A gripping mechanism for a printing machine having a rotatable drum 2 for supporting a sheet 8 to be printed is arranged so that the gripper 34 moves in a first path B to grip the sheet and in a second, different path to release the sheet. The first path B preferably has directional components extending radially inwardly of the drum and tangentially in the direction of rotation A of the drum, so that the sheet is pulled into engagement with a register 56 fixed with respect to the surface of the drum. The second path is both outwardly of and in the direction of rotation of the drum.

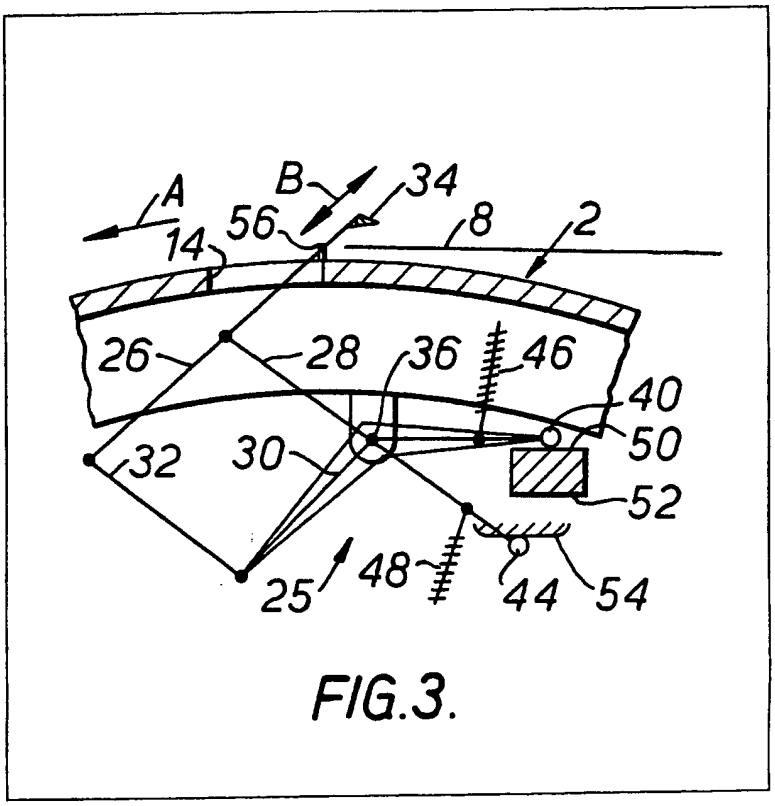

FIG.3.

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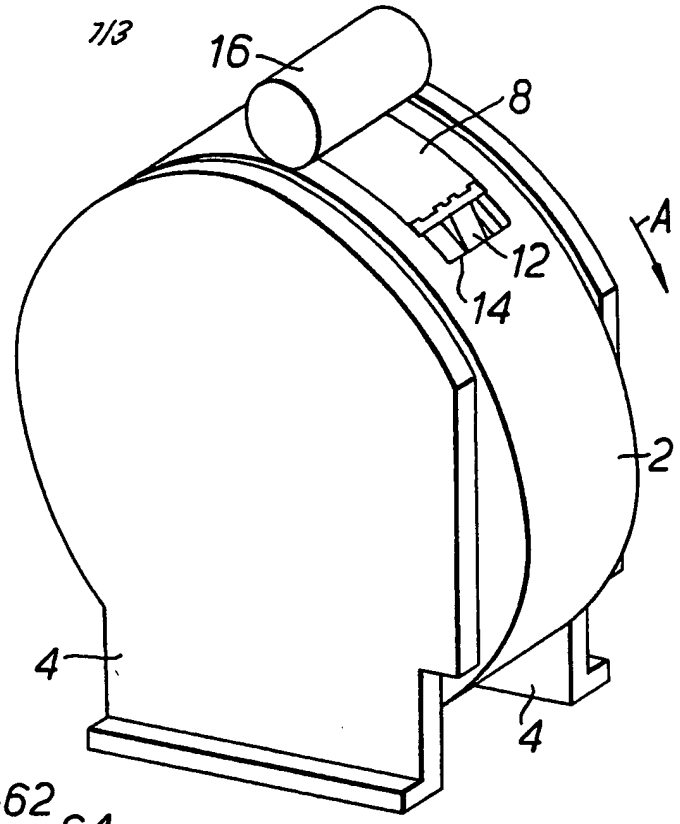
The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

FIG.1.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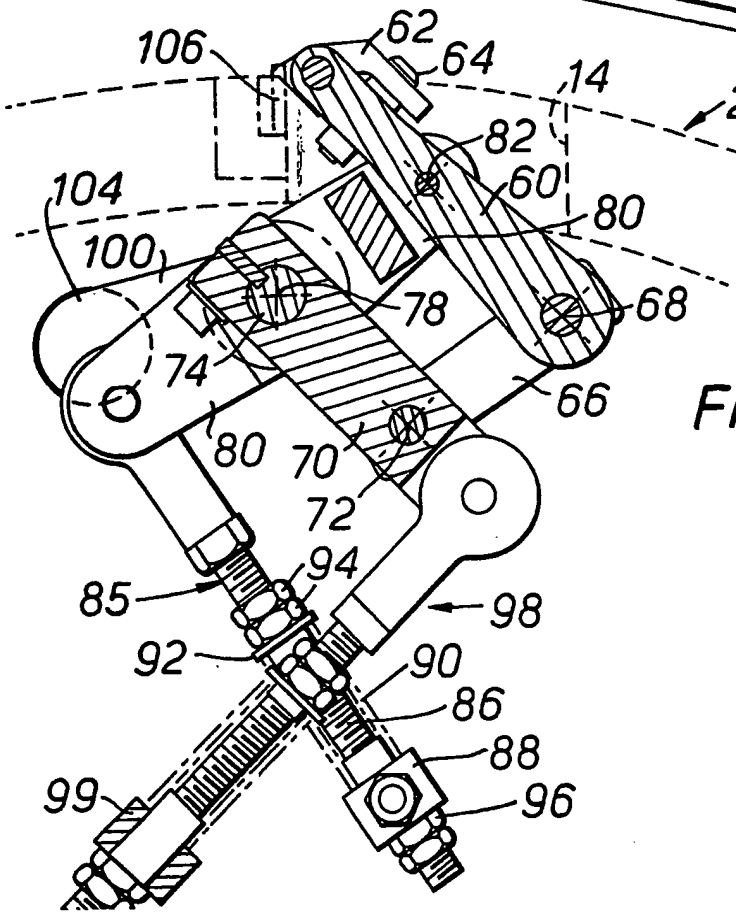
8
12
14
A
2
4
4


106
62
64
14
2
82
60
80
104
100
78
68
74
66
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70
72
94
85
98
92
90
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99
96

FIG.6.

FIG.2.

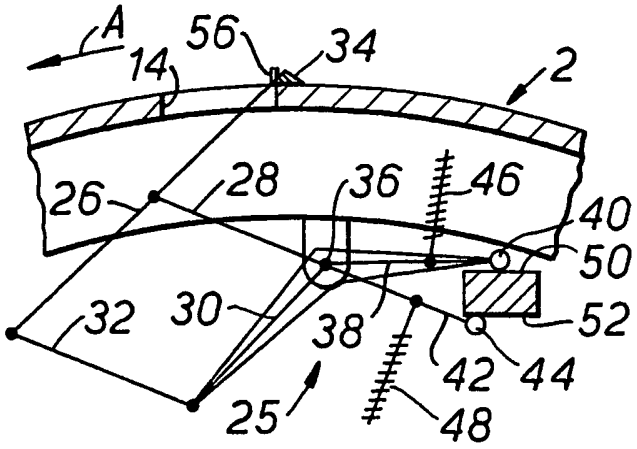


FIG.3.

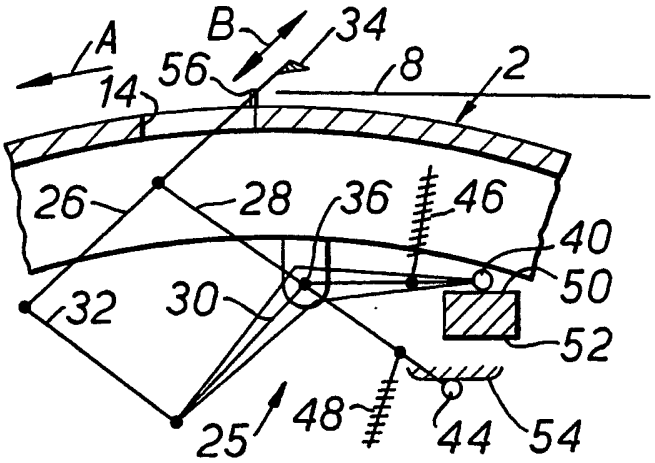


FIG.4.

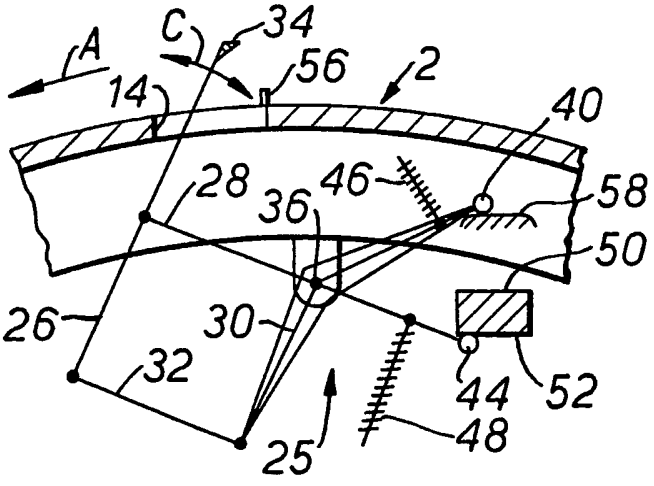
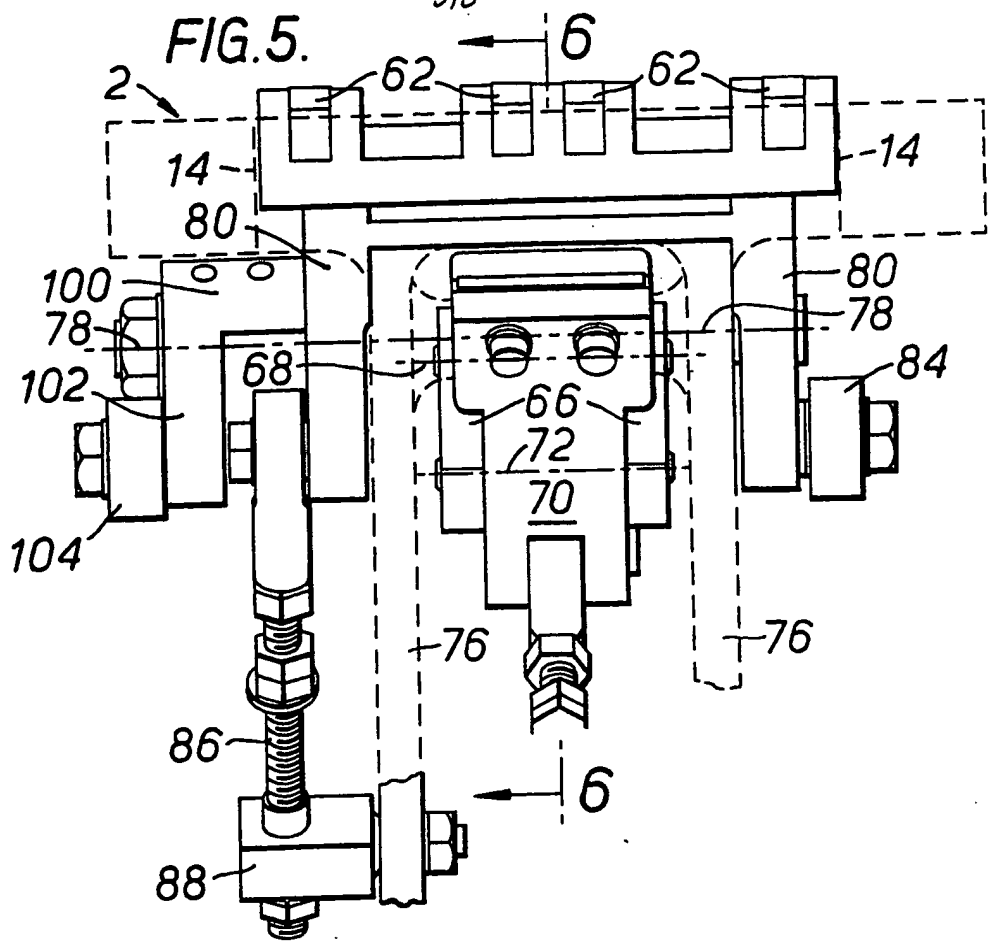


FIG.5.


6
62
62
2
14
14
80
100
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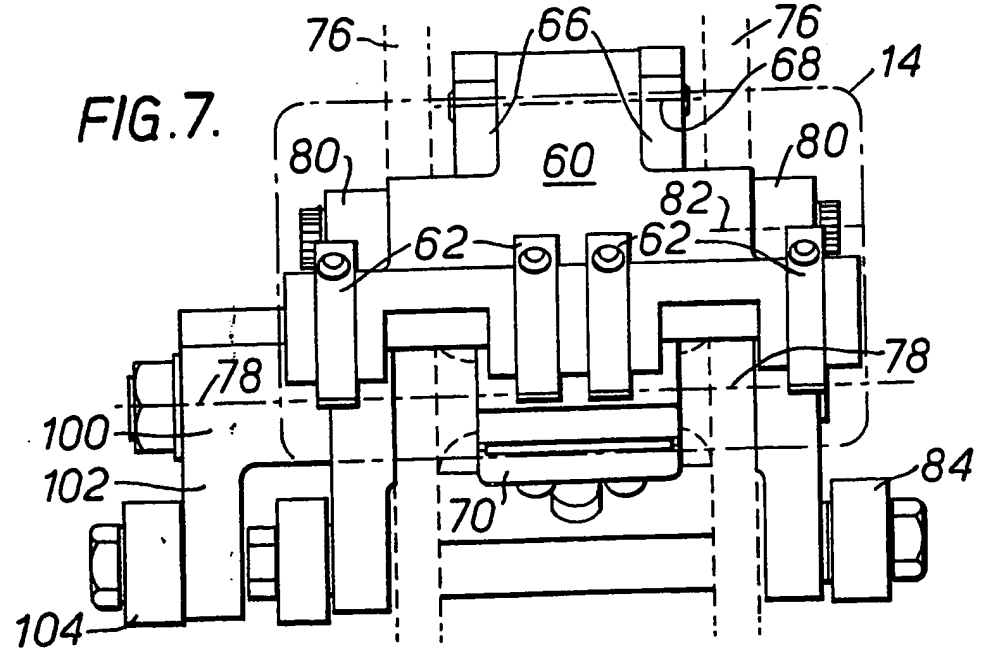
78
78
68
84
102
66
72
70
104
76
76
86
6
88

FIG.7.


76
66
76
68
14
80
60
80
82
62
62
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100
102
84
70
104

SPECIFICATION

Gripping mechanism for printing machine

This invention relates to printing machines for applying a coating or print to a flat sheet, the printing machine incorporating a rotatable drum on which the sheet is supported when the coating or print is applied. The invention is particularly concerned with a gripping mechanism for such a machine, which grips the leading end of the sheet to hold the sheet on the drum.

Previously, such gripping mechanisms have incorporated an elongate member, which can be formed with teeth, extending across the surface of the drum and biased toward the surface so that the leading end of a sheet can be located under this member and held in position on the surface of the drum. An elongate register or lay is fixed to the member and abuts the leading edge of the sheet to ensure that the sheet is correctly positioned on the surface of the drum.

The elongate member and the lay thus form a gripper, and this is pivotally mounted for movement away from and toward the surface of the drum. When the sheet is fed to the gripper in a tangential direction with respect to the drum, the gripper is released for movement toward the surface of the drum thereby to clamp down on the leading end of the sheet. The gripper is later pivoted away from the surface of the drum to release the sheet.

The correct operation of the gripper depends upon the precise movement executed by the gripper during the feeding and release operations; it is necessary to ensure not only that there is sufficient movement radially of the cylinder to open the gripper enough so that the leading end of the sheet can be inserted and brought into engagement with the lay before being clamped down, but also that there is sufficient tangential movement of the gripper to clear the sheet in order to release the sheet for radial movement from the drum. This means that the pivotal movement of the gripper has to be fairly large.

In accordance with a first aspect of the present invention, the gripping mechanism is so arranged that the gripper moves in a first path when gripping the sheet, and in a second, different path when releasing the sheet. This contrasts with the prior art, in which the gripper moved in opposite directions along the same path when gripping and when releasing the sheet.

Because the gripper in the mechanism of the invention moves in different paths on releasing and gripping the sheet, it is possible to optimise the movement of the gripper for both operations. During the release operation, the gripper preferably moves substantially tangentially to the surface of the drum in the direction of movement of the drum. This permits the gripper quickly to move away from the sheet to release the sheet, so that little movement of the gripper is required. During the feed operation, the gripper moves toward the surface of the drum to clamp the sheet to the surface.

Another disadvantage of the gripping mechanism of the prior art results from the fact that, during the final stage of movement of the gripper when clamping the sheet to the drum, the gripper moves in a substantially radial path with respect to the surface of the drum. This means that the sheet is fixed in whatever position it occupies as the gripper closes upon the sheet. In some cases the sheet may not be correctly positioned with its front edge in abutment with the register when it is fixed in position on the drum.

According to a second aspect of the invention, a register or lay against which in use the front edge of the sheet abuts, is fixed to the surface of the drum, and the mechanism is arranged so that the gripper moves with respect to the surface of the drum not only toward the surface but also in the direction of movement of the surface during the feeding operation. In this way, the gripper will have a tendency to pull the sheet toward the register, if they are not aleady in engagement, while closing down on the sheet to ensure accurate positioning of the sheet on the surface of the drum.

In use of a gripping mechanism of the invention, it has been found that feeding and release of the sheets to and from the gripper, with correct positioning of the sheets with respect to the register, can be achieved reliably and easily, and that very little movement of the gripper is required.

In a preferred embodiment of the invention, the gripping mechanism comprises a four-bar linkage, preferably a parallelogram linkage, the gripper itself forming one of the bars of the linkage. Two other bars of the linkage are pivoted about an axis which is fixed with respect to the drum, one of these also being directly pivoted to the gripper and the other being pivotally connected to the gripper via a fourth bar of the linkage. Pivoting of one of the bars which is mounted on the fixed pivot axis causes movement of the gripper in its first path to grip the sheet, whereas pivoting of the other bar mounted on the fixed pivot axis causes movement of the gripper in its second path to release the sheet.

An arrangement embodying the invention will now be described by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a perspective, schematic view of a printing machine incorporating a gripping mechanism in accordance with the invention;

Figures 2 to *4* are schematic views showing the operation of the gripping mechanism of the invention; and

Figures 5, 6 and *7* are respectively a front view, a side view and a plan view of the gripping mechanism of the invention, Figure 6 being a sectional view on lines 6-6 of Figure 5.

Referring to Figure 1, the printing machine incorporates a rotatable drum 2 mounted for rotation about its axis between the opposite sides of a frame 4.

Driving means (not shown) are provided to rotate the drum in the direction of the arrow A. As the drum is rotated, flat sheets 8 are delivered individually to the surface of the drum 2.

As each sheet 8 is delivered to the cylindrical surface of the drum 2, the leading edge of the sheet

is gripped by a gripper 12 extending through an aperture 14 in the surface of the drum 2.

The sheet is carried around on the drum by the gripper 12, and is brought under a print roller 16. As the sheet passes under the roller 16, a coating of, e.g. paint or ink is applied to the sheet.

After the gripper 12 has passed the roller 16, it releases the leading edge of the sheet 8 so that the sheet can be removed from the drum 2.

As will be described below, the gripper 12 ensures that the sheet 8 is positioned accurately on the surface of the drum 2. This means that the coating will be applied in the correct areas on the sheet. Also, if the sheet is to be coated again by being fed through another printing machine, the coats will be in correct registry.

The operation of the gripping mechanism will now be described with reference to Figures 2 to 4, which are schematic side views of the gripping mechanism.

Referring to Figure 2, the mechanism 25 essentially comprises a parallelogram linkage including pivotally interconnected bars 26, 28, 30 and 32. The bar 26 extends beyond the pivotal connection to the bar 28 through the aperture 14 in the surface of the drum 2, and carries a plurality of teeth 34 spaced across the width of the drum. The bar 26 and teeth 34 form the gripper 12 of the mechanism 25.

The bar 28, which is pivotally connected at one end to the mid-portion of the bar 26, and the bar 30 ae pivoted about a common axis 36 which is fixed with respect to the drum 2. The ends of the bars 26 and 30 are pivotally connected to respective ends of the bar 32.

The bar 30 has an extension 38 which carries at its end a cam follower 40. The bar 28 also has an extension, indicated at 42, and this also carries a cam follower 44 at its end. The linkage is biased to the position shown in Figure 2 by a pair of compression springs 46 and 48, acting on the extension 38 of the bar 30 and the extension 42 of the bar 28, respectively. The movement of the extensions 38 and 42 by the force of the springs 46 and 48 is limited by stops 50 and 52 respectively.

In the position shown in Figure 2, the teeth 34 of the gripper are biased toward the surface of the drum by the compression springs 46 and 48.

As the gripping mechanism 25 is carried to the position at which sheets are fed to the surface of the drum, the cam follower 44 comes into engagement with a cam 54 (see Figure 3) which is fixed to the frame 4 of the printing machine. This causes the bar 28 to pivot about the axis 36 against the bias of the compression spring 48, until the cam follower 44 moves clear of the cam 54, whereupon the bar 28 returns to the position shown in Figure 2. As a result of this, the gripper is caused to reciprocate in a first path indicated by the arrow B in Figure 3, this path being substantially linear.

The position of the cam 54 is such that the sheet 8 is fed to the gripper when the gripper is open as shown in Figure 3. As the gripper closes, its movement has not only a radially inward component, but also a component which is tangential to the drum in the direction A of rotation of the drum. As a result of this, the teeth 34, after engaging the leading end of the sheet 8, tend to pull the front edge of the sheet into abutment with a register 56 fixed to and extending outwardly from the drum 2. This ensures correct positioning of the sheet on the surface of the drum.

Thereafter, with the gripping mechanism in the position shown in Figure 2, and the sheet 8 clamped under the teeth 34, the drum rotates until the sheet approaches the position at which it leaves the drum.

At this point, the cam follower 40 momentarily comes into contact with a second cam 58, also fixed to the frame 4 of the printing machine. This causes the bar 30 to pivot about the fixed axis 36.

The momentary contact of the cam follower 40 with the cam 58 causes the gripper to reciprocate in a second parth indicated by the arrow C in Figure 4. The movement of the teeth as the cam follower comes into contact with the cam has a substantial component which is tangential to the drum in the direction A of rotation. As a result, the teeth quickly clear the leading end of the sheet 8, thus releasing the sheet.

After the cam follower 40 moves past the cam 58, the gripping mechanism adopts the position shown in Figure 2, until it next reaches the feeding position.

Figures 5 to 7 show a practical embodiment of the gripping mechanism 25. The mechanism is fitted to a drum 2 indicated in broken lines, having an aperture 14. The gripper comprises a substantially T-shaped plate 60 (corresponding to the bar 26 in Figures 2 to 4). Four teeth 62 are pivotally mounted along the upper end of the bar 60, and can be adjusted by bolts 64.

A pair of links 66 (corresponding to the bar 32 in Figures 2 to 4) is pivotally mounted to the lower end of the plate 60 for movement about an axis 68. The other ends of the links 66 are pivotally mounted to a block 70 for movement about an axis 72. The block 70 corresponds to the bar 30 of Figures 2 to 4.

The block 70 is clamped and keyed to a shaft 74 which is mounted in a pair of bearings (not shown), one on each side of the block 70. Each bearing is fixedly mounted in a respective web 76 of the drum 2. The webs 76 are parallel, and extend in planes perpendicular to the axis of rotation of the drum. The shaft 74 rotates about an axis 78 which corresponds to the fixed axis 36 shown in Figures 2 to 4.

A substantially H-shaped member 80 has its upper ends pivotally mounted one on each side of the plate 60 about a common axis 82. The lower legs of the member 80, which are located outside the webs 76, are mounted for rotation about the shaft 74. The H-shaped member 80 corresponds to the bar 28 in Figures 2 to 4.

One of the lower legs of the member 80 carries a cam follower 84 at its end. The other of the lower legs is pivotally connected to an assembly 85 including a threaded shaft 86 which is slidably mounted in a block 88 rotatably secured in the adjacent web 76 of the drum 2. A compression spring indicated in Figure 6 at 90 extends between the block 88 and a collar 92 held in position by nuts 94 on the rod 86. The compression spring 90 biases the rod 86 upwardly, the movement being limited by

the engagement of a nut 96 with the block 88, the block 88 thus forming a stop.

The lower end of the block 70 forms a yoke between the arms of which is mounted an assembly 98, similar to the assembly 85, and also including a slidably mounted threaded rod carrying a compression spring. The rod slides in an aperture through a bar 99 which is pivotally mounted at each end to a respective one of the webs 76, and which forms a further stop.

A block 100 is secured on one end of the shaft 74 and has an extension 102 carrying a second cam follower 104.

The cam followers 84 and 104 correspond to the followers 44 and 40, respectively, of Figures 2 to 4.

When the cam follower 84 engages a cam fixed to the frame of the machine, the H-shaped member 80 is pivoted in an anti-clockwise direction as seen in Figure 6 about the axis of the shaft 74. This moves the gripper teeth 62 upwardly and to the left as shown in Figure 6, corresponding to the movement indicated in Figure 3.

When the cam follower 104 engages a further cam mounted on the frame 4, the shaft 74 is rotated about its axis 78, thus causing the block 70 to rotate in a clockwise direction. This causes the link 66 to pull the lower end of the plate 60 so as to cause clockwise pivoting of the plate about the axis 82, thus obtaining a release movement of the type shown in Figure 4.

The register or lay is indicated at 106 in Figure 6. This is formed by a plurality of spaced, upstanding portions arranged to permit the teeth 62 to move therebetween.

Very little movement of the gripper is required for reliable operation. Further, the timing of the feeding and release operations can be made accurate by appropriate individual adjustment of the two cams, which are located on opposite sides of the machine frame, and which contact the followers 84 and 104 respectively. Each cam need be located at only one particular position around the axis of the drum, rather than completely around the axis, as the mechanism is biased to a normal gripping position in the absence of the cams.

CLAIMS

1. A gripping mechanism for a printing machine having a rotatable drum for supporting a sheet to be printed, the mechanism having a gripper which is operable to grip the sheet, hold the sheet in position on the drum as the latter is rotated, and then release the sheet, wherein the mechanism is arranged so that the gripper moves in a first path when gripping the sheet, and in a second, different path when releasing the sheet.

2. A mechanism as claimed in claim 1, arranged so that the gripper, in use, moves with respect to the surface of the drum not only toward the surface but also in the direction of movement of the surface when gripping the sheet.

3. A mechanism as claimed in claim 1 or claim 2, arranged so that the movement of the gripper with respect to the surface of the drum when releasing the sheet is both outward and in the direction of movement of the drum.

4. A mechanism as claimed in any preceding claim, comprising a four-bar linkage, the gripper forming a first bar of said linkage, a second bar and a third bar of said linkage being pivoted about an axis which is in use fixed with respect to the drum, said second bar also being pivoted to said gripper, said third bar being pivoted to a fourth bar of said linkage, and said fourth bar also being pivoted to said gripper.

5. A mechanism as claimed in claim 4, wherein pivoting of said second bar about said fixed axis causes the gripper to move in said first path, and pivoting of said third bar about said fixed axis causes the gripper to move in said second path.

6. A mechanism as claimed in any preceding claim, including means for biasing the gripper to a position in which the sheet is held on the surface of the drum, and cam follower means engageable with cam surfaces to cause the gripper to grip and to release the sheet.

7. A mechanism as claimed in claim 6, as appendant to claim 4 or claim 5, wherein said cam follower means comprises a first cam follower carried by said second bar and a second cam follower carried by said third bar.

8. A mechanism as claimed in claim 6 or claim 7 and including a first, fixed cam for engaging said cam follower means to cause the gripper to grip the sheet and a second, fixed cam for engaging said cam follower means to cause the gripper to release the sheet.

9. A gripping mechanism for a printing machine, substantially as herein described with reference to Figues 2 to 4, or Figures 5 to 7 of the accompanying drawings.

10. A combination of a gripper mechanism as claimed in any preceding claim and a rotatable drum, the mechanism being operable to grip and hold a sheet on the drum.

11. A combination as claimed in claim 10, including a register which is fixed with respect to the surface of the drum and against which, in use, the leading edge of the sheet abuts.

12. A combination as claimed in claim 10 or claim 11, forming part of a printing machine operable to print on a sheet held on the drum.

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Applic. #_____

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